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GROUP 3700

In the Claims

1. (Original) A method of acquiring free-breathing MR images comprising the steps of:

monitoring heart rate of a subject just prior to image acquisition to acquire a time period of an R-R interval;

recording the time period from the heart rate monitoring to prospectively estimate future R-R intervals; and

acquiring n sets of MR data, a first MR data acquisition commencing at any point in an R-R interval and extending for the time period recorded.

2. (Original) The method of claim 1 further comprising the steps of segmenting each MR data acquisition into n segments and repetitively acquiring each segment in n successive heartbeats.

3. (Original) The method of claim 2 further comprising the step of combining the n MR data sets to form a set of MR images with high temporal resolution covering the R-R interval.

4. (Original) The method of claim 1 further comprising the step of discontinuing heart rate monitoring before acquiring MR image data.

5. (Original) The method of claim 1 wherein a second set of MR data is acquired immediately after the acquisition of the first set of MR data.

6. (Original) The method of claim 2 wherein n=1 for fluoroscopy imaging.

7. (Original) The method of claim 1 wherein the step of acquiring MR data is performed using one of a fast gradient-recalled echo pulse sequence and a steady state free precession pulse sequence.

8. (Original) The method of claim 1 further comprising the steps of:
subjecting a patient to successively increased, graded levels of cardiac stress during the monitoring step until the heart rate is stabilized at a required stress level; and

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acquiring MR data according to the acquisition step of several long and short axis views of at least a portion of a heart muscle to monitor cardiac function during any portion of a stress test.

9. (Original) The method of claim 8 wherein the cardiac stress is induced either by physical stress or administration of a pharmaceutical.

10. (Withdrawn) A computer program for use with an MRI scanner having a computer, the computer program having a set of instruction that, when executed, cause the computer to:

receive a time-period signal indicative of an R-R interval representing a cardiac cycle of a patient;

acquire a first set of partial MR image data during a first acquisition period equal to the R-R interval;

acquire a second set of partial MR image data during a second acquisition period equal to the R-R interval; and

reconstruct an MR image by combining the first set of partial MR image data with the second set of partial MR image data.

11. (Withdrawn) The computer program of claim 10 having further instructions to acquire n sets of partial MR image data, each frame of data in a partial MR data set being acquired at a similar time of a corresponding frame of data in each partial MR data set during the R-R interval.

12. (Withdrawn) The computer program of claim 10 wherein the acquisition of MR data is not gated to an ECG trigger.

13. (Withdrawn) The computer program of claim 10 wherein the acquisition of each set of partial MR data is acquired at a time irrespective of either one of an R-R interval start and end.

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14. (Withdrawn) The computer program of claim 10 wherein each portion of MR data is a segment of an MR data set.

15. (Withdrawn) The computer program of claim 10 wherein one-half of k-space image data for a given segment is acquired during each R-R time period.

16. (Withdrawn) The computer program of claim 10 wherein even and odd numbered lines of a k-space matrix are acquired in successive R-R intervals.

17. (Withdrawn) The computer program of claim 10 having further instructions to monitor heart rate and generate an R-R time period indicative of a current R-R interval in a patient while the MR scanner is idle.

18. (Withdrawn) The computer program of claim 10 having further instructions to periodically monitor heart rate and generate an R-R time period before and after each acquisition of MR data and not during any acquisition of MR data.

19. (Withdrawn) An MRI apparatus to acquire high-temporal resolution images comprising:

a magnetic resonance imaging (MRI) system having a plurality of gradient coils positioned about a bore of a magnet to impress a polarizing magnetic field and an RF transceiver system and an RF switch controlled by a pulse module to transmit RF signals to an RF coil assembly to acquire MR images; and

a computer programmed to:

monitor heart rate of a patient;

acquire a time period of an R-R interval of the heart rate;

store the time period of the R-R interval;

enable the MRI system and begin an MR scan of the patient at an arbitrary time in the R-R interval;

continue to acquire MR data for a time comparable to the time period stored; and

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reconstruct an MR image with the MR data acquired over at least one R-R interval as estimated by the time period stored.

20. (Withdrawn) The MRI apparatus of claim 19 wherein the computer is further programmed to:

segment data acquisition such that a portion of data is acquired during each acquisition; and

combine the segmented data acquired to reconstruct the MR image.

21. (Withdrawn) The MRI apparatus of claim 19 wherein the computer is further programmed to acquire n sets of MR data, each having m frames, where each frame is segmented into n segments and the m frames fit within one R-R interval.

22. (Withdrawn) The MRI apparatus of claim 19 wherein the computer is further programmed to apply one of a fast gradient-recalled echo pulse sequence and a steady state free precession pulse sequence.

23. (Withdrawn) The MRI apparatus of claim 19 wherein the computer is further programmed to acquire one-half of k-space image data for a given segment during each R-R time period.

24. (Withdrawn) The MRI apparatus of claim 19 wherein the computer is further programmed to acquire even and odd numbered lines of a k-space matrix in successive R-R intervals.

25. (Withdrawn) An examination method comprising the steps of:
subjecting a patient to successively increasing levels of cardiac stress;
monitoring heart rate;
once the heart rate is stabilized at a desired stress level, recording a time period of an R-R interval;
acquiring non-gated MR data using the time period recorded to estimate R-R intervals.

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26. (Withdrawn) The examination method of claim 25 wherein the cardiac stress is induced by one of either physical exercise or administration of a pharmaceutical.

27. (Withdrawn) The examination method of claim 25 wherein the step of acquiring MR data includes acquiring segments of each frame of data over successive R-R intervals.

28. (Withdrawn) The examination method of claim 25 further comprising the step of combining the segments for each frame to reconstruct an image with high-temporal resolution without requiring patient breath-holding.

29. (Withdrawn) The examination method of claim 25 where a fraction of total k-space is acquired during each cardiac R-R interval.

30. (Withdrawn) The examination method of claim 29 where the step of acquiring MR data includes acquiring segments of each frame of data over successive n R-R intervals in order to complete data acquisition for a CINE data set.

31. (Withdrawn) The examination method of claim 30 further comprising repeating the acquisition to provide an updated CINE data set every n R-R intervals.

32. (Withdrawn) The examination method of claim 31 further comprising displaying continuous cardiac wall motion activity in order for an operator to monitor cardiac wall motion in real-time.